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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/588,899	08/09/2006	Masayasu Miyata	9319A-001819/US/NP	4040
27572 7590 07/02/2010 HARNESS, DICKEY & PIERCE, P.L.C. P.O. BOX 828 BLOOMFIELD HILLS, MI 48303			EXAMINER CAO, PHAT X	
			ART UNIT 2814	PAPER NUMBER
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**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

<b>Office Action Summary</b>	<b>Application No.</b> 10/588,899	<b>Applicant(s)</b> MIYATA, MASAYASU	
	<b>Examiner</b> Phat X. Cao	<b>Art Unit</b> 2814	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

### Status

- 1) ☒ Responsive to communication(s) filed on 02 April 2010.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

### Disposition of Claims

- 4) ☒ Claim(s) 1,5,7,10,13,14 and 16 is/are pending in the application.
- 4a) Of the above claim(s) 16 is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1,5,7,10,13 and 14 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

### Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some \* c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
  - ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  - ☒ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

### Attachment(s)

- |   |   |
|---|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892)                    | 4) <input type="checkbox"/> Interview Summary (PTO-413)           |
| 2) <input type="checkbox"/> Notice of Draftperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____                                      |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08)         | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| Paper No(s)/Mail Date _____   | 6) <input type="checkbox"/> Other: _____                          |

### **DETAILED ACTION**

1. Newly submitted claim 16 is directed to an invention that is independent or distinct from the invention originally claimed for the following reasons: original claim 1 claiming a gate insulating film being composed of silicon oxide including either hydrogen or deuterium, and nitrogen; and new claim 16 claiming a gate insulating film being composed of silicon oxide including either hydrogen or deuterium, and at least one other element selected from a group comprising carbon, aluminum, hafnium, zirconium and germanium. Therefore, original claim 1 and new claim 16 are distinct species.

Since applicant has received an action on the merits for the originally presented invention, this invention has been constructively elected by original presentation for prosecution on the merits. Accordingly, claim 16 is withdrawn from consideration as being directed to a non-elected invention. See 37 CFR 1.142(b) and MPEP § 821.03.

### ***Claim Rejections - 35 USC § 103***

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

3. Claims 1, 7, 10 and 13-14 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kusunoki et al (US 2002/0066934).

Regarding claim 1, Kusunoki (Fig. 11) discloses a semiconductor device comprising: a base 1 including a semiconductor material, the base 1 having a source

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region 6, a drain region 7 and a channel region 35 disposed between the source region 6 and the drain region 7; a gate insulating film 22 disposed in contact with the channel region 35 of the base 1; and a gate electrode 5 disposed on the gate insulating film 22; the gate insulating film 22 includes silicon, oxygen, hydrogen and nitrogen (par. [0074]), the nitrogen being diffused to the gate insulating film 22 (par. [0074]) so as to reduce the hydrogen residing in the vicinity of an interface between the gate insulating film 22 and the channel region 35 of the base, the gate insulating film 22 having a region where  $B/A$  is in a range of 1.2 or more, a concentration of nitrogen in the region is defined as  $A = 2.5 \times 10^{20}$  atoms/cm<sup>3</sup> or more and a concentration of hydrogen in the region is defined as  $B = 3 \times 10^{20}$  atoms/cm<sup>3</sup> or more (par. [0074]), the region being located at a portion of the gate insulating film 22 at a distance toward a thickness direction of  $Y/10$  of the gate insulating material from the interface,  $Y$  being an average thickness of the gate insulating material 22.

Kusunoki discloses that the value of the region  $B/A$  is 1.2 or more but does not disclose that the value of the second region  $B/A$  is 1.6 or more as claimed.

However, there is no evidence of record to indicate that the value of the region  $B/A$  of the gate insulating film being equal or higher than 1.6 will achieves unexpected results over the value of the region  $B/A$  of the gate insulating film being equal 1.2 or more. The examiner specifically notes page 19 (first paragraph) of Applicant's specification. This page states that " $B/A$  ... more preferably it is 2 or less". This applicant's specification appears to support the examiner's position that the value of the region  $B/A$  having value being equal or higher than 1.6 does not perform different than

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the value of the region B/A having value being equal 1.2 or more as taught by Kusunoki. Furthermore, it has been held that a *prima facie* case of obviousness exists where the claimed ranges and prior art ranges do not overlap but are close enough that one skilled in the art would have expected them to have the same properties. *Titanium Metals Corporation of America v. Banner*, 778 F.2d 775, 227 USPQ 773 (Fed. Cir. 1985).

Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention, to form the value of the region B/A being 1.2 or more as suggested by Kusunoki or 1.6 or more as claimed because the value of the region B/A can be optimized during routine experimentation by changing the concentration of nitrogen or hydrogen, and the same effects of improving an efficiency of injection of channel hot electrons and suppressing of an interface level would result (see par. [0026] of Kusunoki).

Regarding claim 7, Kusunoki (Fig. 11) further discloses that the gate insulating material is formed into a gate insulating film 22 and the average thickness of the gate insulating film 22 is 10 nm (par. [0074]).

Regarding claim 10, it has been held that where the claimed and prior art products are identical or substantially identical in structure or composition, or are produced by identical or substantially identical processes, claimed properties or functions are presumed to be inherent. *In re Best*, 195 USPQ 430, 433 (CCPA 1977). In this case, because the gate insulating film of claimed device and the gate insulating film of Kusunoki's device both have substantially identical in structure and composition, claimed property of having the maximum leakage current passing through the gate

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insulating film being  $2 \times 10^{-8}$  A/cm<sup>2</sup> or less when the electric field intensity in the gate insulating film being 3 MV/cm is presumed to be inherent.

Regarding claims 13-14, Kusunoki further discloses that an electronic apparatus comprising an electronic device of flash EEPROM (see Fig. 54, and par. [0008]).

4. Claim 5 is rejected under 35 U.S.C. 103(a) as being unpatentable over Kusunoki et al in view of Hori et al (US 6,215,163).

Kusunoki does not disclose the concentration of hydrogen and the concentration of nitrogen are measured by Secondary Ion Mass Spectrometry (SIMS).

It is noted that the process limitations (i.e., measured by means of Secondary Ion Mass Spectrometry ) recited in a “product by process” claim would not carry patentable weight in a claim drawn to structure because distinct structure is not necessarily produced. *In re Thorpe*, 227 USPQ 964 (Fed. Cir. 1985). However, Hori teaches the known feature of using Secondary Ion Mass Spectrometry to measure the concentration of hydrogen and the concentration of nitrogen in the silicon oxynitride insulating layer (see Fig. 4 and column 8, lines 8-13).

### ***Response to Arguments***

5. Applicant's arguments filed 4/2/10 have been fully considered but they are not persuasive.

Applicant argues that the gate insulating film 22 of Kusunoki is completely different from the gate insulating film of the claimed invention due to the present of nitride (page 8 of remark).

This argument is not persuasive because there is no different between the gate insulating films of Kusunoki and the claimed invention because they both are composed of silicon oxide including hydrogen and nitride.

Applicant further argues that Kusunoki does not suggest "the nitrogen being diffused to the gate insulating film" as claimed (pages 8-9 of remark).

This argument is not persuasive because Kusunoki clearly teaches that the nitriding of the silicon oxide film 2 is performed by exposing the silicon oxide film 2 to ammonia atmosphere at a specific temperature (par. [0074]). It is noted that there is no different between the processes of Kusunoki and the present invention for diffusing the nitrogen into the gate insulating film because in the present invention, the nitrogen being diffused into the gate insulating film is also performed by exposing the silicon oxide film to ammonia atmosphere at a specific temperature in a heat treatment (see page 28 of Applicant's specification). It is further noted that the process limitations recited in a "product by process" claim would not carry patentable weight in a claim drawn to structure because distinct structure is not necessarily produced. In re Thorpe, 227 USPQ 964 (Fed. Cir. 1985).

### ***Conclusion***

6. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

7. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Phat X. Cao whose telephone number is (571)272-1703. The examiner can normally be reached on M-F.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Wael Fahmy can be reached on (571)272-1705. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.



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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/P. X. C./  
Primary Examiner, Art Unit 2814

/Phat X. Cao/  
Primary Examiner, Art Unit 2814